Robots, Job characteristics and Job Insecurity

Tom Coupe1†

Abstract: In this paper, I use data from a recent Pew survey to analyse the reasons behind people's fear of losing their job to robots. I find that more people fear losing their job to other people than fear losing it to robots, that people who fear robots typically also fear losing their job for other reasons and that many job and individual characteristics that correlate with the fear of losing one's job to robots also correlate with the fear of losing one's job for other reasons. Finally, I find only limited evidence that job characteristics identified by experts as being robot proof are related to lower job insecurity.

Keywords: job insecurity, robots, computers, technology, skills

JEL Classifications: O33, J63, J24

1 Department of Economics and Finance, University of Canterbury, NEW ZEALAND
Private Bag 4800, 8140 Christchurch, New Zealand

† Email: tom.coupe@canterbury.ac.nz

Introduction

In this paper, I analyse people's perception of computers, machines and robots (from here 'robots') as a source of job insecurity. With the recent advances in machine learning and artificial intelligence, many observers argue that jobs are now in real danger. Drum (2017), for example, writes: 'I want to tell you straight off what this story is about: Sometime in the next 40 years, robots are going to take your job'. The book by Ford (2015) is titled *Rise of the Robots: Technology and the Threat of a Jobless Future* and argues that 'Artificial intelligence is already well on its way to making "good jobs" obsolete: many paralegals, journalists, office workers, and even computer programmers are poised to be replaced by robots and smart software'. This concern has also reached policy makers: Stewart and Asthana (2017), for example, quote UK Labour Party leader Jeremy Corbyn as saying 'We need urgently to face the challenge of automation, robotics that could make so much of contemporary work redundant'. Similarly, in 2017, a vote in the European Parliament urged the European Commission to set regulatory standards for robots (European Parliament, 2017), while Pethokoukis (2017) reports that an American senator is drafting a similar bill.

In my analysis, I review the results of various recent surveys that ask respondents about their views of the impact of robots on their own jobs and on employment in general and analyse in greater depth the results of a recent Pew survey that allows me to compare robots as a source of job insecurity with other sources of job insecurity.

There is already a sizeable academic literature on job insecurity (see f.e. Shoss (2017) or Sverke et al. (2006) for comprehensive reviews of the literature). Analysing perceived job insecurity is important, as job insecurity has been shown to relate to various economic outcome variables, like health (Green, 2012; Reichert and Tauchmann, 2017), life satisfaction (Geishecker, 2012) and savings (Klemm, 2010). Regarding its determinants, perceived job insecurity is found to vary with the macro-economic situation (f.e. the level of unemployment), company characteristics (like company performance), job characteristics (like blue- versus white-collar jobs) and individual-level characteristics (such as personality traits or minority status). There is one study that investigates the impact of robots on job insecurity; Morikawa (2017) finds that Japanese employees who have vocational or postgraduate education, have a natural science major or hold an occupational license are less likely to fear losing their job to robots.[1]

[1] Besides using data from the US rather than from Japan, this paper also differs from Morikawa (2017) in the availability of more detailed job characteristics, the availability of questions that relate to other sources of job

My analysis of job insecurity complements the literature that relates changes in actual employment with the use of computers (e.g. Autor et al., 2003; Bessen, 2015) or robots (Acemoglu and Restrepo, 2017). While these papers use past data on actual changes in jobs at the level of industry or occupation, the perceived job security analysed here is instead forward looking, reflecting the expectations of job changes. Note that perceived job insecurity is shown to correlate with realized job insecurity (for example, Campbell et al. (2007) and Dickerson and Green (2012) show that perceived job insecurity predicts future job loss).

After considering the relative importance of robots as a source of job insecurity, I investigate whether some jobs are relatively more robot proof than others, because they require skills in which robots are still thought to be inferior to people, like interpersonal communication or creativity (as has been argued, for example, by Brynjolfsson and McAfee (2014), Fagan (2017) and others). I check these claims by determining whether respondents who work in jobs in which those skills are needed are less likely to indicate that they are concerned about being replaced by robots.

I find that people rather than robots are a major concern for many. The share of respondents who are concerned about losing their job because they will be replaced by cheaper people or due to poor management is substantially larger than the share of people who fear losing their job to robots. Moreover, most of the people who fear robots are also insecure about their job for other reasons. Hence, there are relatively few people who feel insecure about their jobs only because of robots. Finally, I find that people with repetitive jobs are more likely to be concerned about robots; there is some evidence that people holding a job that requires considerable interpersonal communication are less likely to be concerned about robots, but there is very little evidence that having a job that requires creativity or specialized technical knowledge makes one less concerned about robots as a source of job loss.

The structure of the remainder of the paper is as follows. After providing details about the available data sets in section II, I use the Pew survey data in a regression analysis in section III. Section IV concludes.

insecurity and the availability of questions that relate to the impact of robots in the short and long run, and on jobs in general.

I. Data

The main data set used in this paper comes from a Pew survey conducted on 10–12 June 2015 in the United States. This survey includes questions asking respondents about the impact of computers, machines and robots on their current employment, the future of their job and the general impact on employment. Besides standard socio-demographic characteristics (gender, age and education), the data set also includes variables reflecting the job characteristics of the respondents.[2]

It is important to note that questions related to employment were posed only to employed respondents. Hence, it is not possible to reach any conclusions about how the unemployed perceive the impact of computers, machines and robots on their own and others' employment opportunities.

The survey contains the answers of 1100 employed respondents. From this sample, I drop the respondents who do not know how to answer a given question or refuse to answer it, leaving a sample of 1001 respondents for whom I have the full range of available data.[3]

Table 1 presents the descriptive statistics. Interestingly, the respondents are more likely to be afraid that they will be replaced by people than by robots: 18% of the respondents in the sample are concerned that they might be replaced by people who will be cheaper than they are, while only 9% are worried that they might be replaced by computers and machines. Similarly, poor management (26%) is seen by more as a reason for concern than a shrinking industry (22%) or an inability to keep up with the technical skills needed to perform their job (12.5%).

[Table 1 about here]

Importantly, when focusing on those who are concerned about losing their job to computers and machines (Table 2), most of these people also fear losing their job for other reasons: 80% of them are concerned about poor management, and 79% are concerned about the possibility of other people replacing them. In fact, only 6.6% of those who are concerned about losing their job to computers and machines report computers and machines as their only source of concern. This constitutes about 0.6% of the sample of employed people that I use here. This suggests that robot-related job insecurity mainly affects people whose job already seems

[2] The descriptive statistics for this survey are provided in the Pew report by Smith (2016). http://www.pewinternet.org/2016/03/10/public-predictions-for-the-future-of-workforce-automation/

[3] For most questions, this is only a couple of people. The only exception is race; about 20 people fall into this category, so I include them in the 'other' race category.

insecure for other reasons rather than affecting people who do not otherwise worry about their job.

[Table 2 about here]

Table 1 further shows that, when asked whether their job will still exist 50 years from now, most people are optimistic: only about 19% think that their job will probably or definitely not exist in 50 years' time. Note that this share is about the same size as the share of people who are currently concerned about being replaced by other people and smaller than the share of people who are currently concerned about losing their job because of their company's poor management. Policy makers who are interested in tackling job insecurity thus could propose the restriction of wage competition or the restriction of the use of robots. However, promoting better management might be not only better for the economy but also more popular.

Further, of those who are not currently worried about their job, 85.2% also are not worried about the existence of their job 50 years from now. At the same time, while a relatively small number of the respondents are concerned about the impact of computers and machines on their own job, almost 60% of the respondents think that, in the next 50 years, computers will carry out much of the work that is currently performed by humans.

One could argue that the low share of people who fear robots for their own job suggests 'ordinary' people underestimate the future impact of artificial intelligence. There are many studies, however, that show that, in general, actual job loss correlates with perceived job insecurity (for example, Campbell et al. (2007) and Dickerson and Green (2012)).

Moreover, other recent surveys show similarly modest fears as far as own job insecurity is concerned. Gallup (2018) surveys 3000 US adults and finds that 73% expect that artificial intelligence will result in a net loss of jobs. At the same time, only 23% of those employed are 'somewhat worried' or 'very worried' that they will lose their job to new technology. Similarly, a Eurobarometer survey (European Commission, 2017) interviewing about 28,000 Europeans reports that 74% agree with the statement that 'due to the use of robots and artificial intelligence, more jobs will disappear than new jobs will be created'. Of those working, however, 53% think that their job could not be performed at all by a robot or artificial intelligence, with another 26% believing that their job could only partially be carried out by robots. Furthermore, 13% indicate that robots could perform most of their job, and 5% confess that their job could be carried out fully by robots.

Finally, Armstrong and Sotala (2012) analyse 95 predictions by both experts and non-experts, who give dates for when artificial intelligence will reach human-comparable cognitive abilities and conclude that there is 'no indication that experts brought any added value when it comes to estimating AI timelines'. Hence, the difference between the respondents' views (on average) and some expert predictions should not be interpreted as implying that respondents are likely to underestimate the impact of robots on their job.

In the next section, I focus on variables that correlate with job insecurity, concentrating on the characteristics of jobs and people that are suggested to be more robot proof. Below are five quotes [bold added] from recent works that single out the competitive advantages of people.

> … our recommendations about how people can remain valuable knowledge workers in the new machine age are straightforward: **work to improve the skills of ideation, large-frame pattern recognition, and complex communication** instead of just the three Rs (reading, writing, and arithmetic). And whenever possible, take advantage of self-organizing learning environments, which have a track record of developing these skills. (Brynjolfsson and McAfee, 2014)

> It [the report] agrees with growing assertions that **creativity and complex problem solving ability to support technology skills** are essential to future workforce success. So will **personal interaction skills and the continuing ability to learn**. (Fagan, 2017)

> While AI has an advantage over humans in many respects, humans still maintain a substantial advantage over AI for tasks that involve **social intelligence, creativity, and general intelligence**. (Furman, 2017)

> A common pattern in recent years is that **routine tasks with little unpredictable variability are more likely to be mechanized**, while jobs that require continuous adjustment to new information and new physical settings along with fine sensory motor-coordination are more difficult to automate. (Mokyr et al., 2015)

> I argue that the interplay between machine and human comparative advantage allows computers to **substitute for workers in performing routine, codifiable tasks while amplifying the comparative advantage of workers in supplying problem-solving skills, adaptability, and creativity**. Autor (2015)

The above quotes point to the importance of creativity and personal interaction skills while viewing repetitive jobs as being at risk. A recent Gallup (2018) survey shows that these expert beliefs are shared widely by the population: 'Nearly half of Americans (49%) say "soft" skills, such as teamwork, communication, creativity and critical thinking, are the most important for U.S. workers to cultivate to avoid losing their jobs to AI. Alternatively, 51% say learning "hard" skills, including math, science, coding and the ability to work with data, are the most important to maintain a job in the face of new technology adoption.'

The respondents to the Pew survey that I analyse here were asked about the characteristics of their job that correspond to these skills identified by the experts. They were asked whether or not their job involves the following characteristics[4]:

a. whether or not the job involves a great deal of personal interaction with customers or clients (76.22% said yes);

b. whether or not the job requires specialized technical knowledge (73.13% said yes);

c. whether or not job the requires creativity (76.72% said yes);

d. whether or not the job requires them to do the same things over and over (63.64% said yes).

It is important to note that these are self-identified job characteristics. The advantage of these is that they provide an assessment of a single job rather than an aggregate categorization being assigned to a job based on, for example, a 'dictionary of occupational titles' (as f.e. in Autor et al., 2003). However, this is accompanied by the drawback of subjectivity; what one can consider as, for example, 'creativity' can vary across individuals. Hence, the analysis here is again complementary to the existing literature on the effect of computers and robots on actual job loss.

II. Regression Analysis

As a starting point, I regress the various job insecurity questions on dummies reflecting these four characteristics, the resulting estimates of which can be found in Table 3. I find that respondents who have a job that involves a great deal of personal interaction are about 5 percentage points less likely to be concerned that they will lose their current job to a machine

[4] About 30% of the respondents indicate all four characteristics, 40% indicate three characteristics, 23% indicate two characteristics, 6.6% indicate one characteristic and 1% indicate none of the possible characteristics.

or computer, while respondents who have a jobs that requires them to perform the same tasks over and over are about 6 percentage points more likely to be concerned that they will lose their current job to a machine or computer (column I). Respondents whose job requires creativity or specialized technical knowledge are not significantly more or less concerned about losing their job to a machine or a computer.

[Table 3 about here]

The same job characteristics are found to be significant for the concerns about the impact of robots on employment in general, though the point estimate of the coefficient of the dummy reflecting that the job requires a great deal of personal interaction is in this case bigger (in absolute value) than the point estimate of the coefficient of the dummy reflecting that the job requires the same tasks to be performed repeatedly (-9.4 versus +5.5 percentage points, column III). As far as the existence of the respondent's job in the future is concerned, none of the estimates of the job characteristic coefficients is significant (column III).

Interestingly, we find that the regressions that have other possible reasons for being concerned about one's current job as the dependent variable (columns IV to VII) show similar patterns to column (I): having a job requiring personal interaction is linked to a decrease in all concerns, with point estimates varying between 9.4 and 12.1 percentage points. Hence, these point estimates are about double those found in column I (concern about robots), though, given that the standard errors are sizeable, I cannot reject the null of equal coefficients. Similarly, having a repetitive job is associated with a higher likelihood of being concerned about robots and other people as well as poor management, with similar point estimates in all three cases. Whether a job requires specialized technical knowledge does not correlate with the likelihood of being concerned about job loss. The same is true for jobs requiring creativity, except that it is related to an increased likelihood of being concerned about losing one's job because of increased technical skills.

These basic regressions thus provide support for the idea that jobs that are not repetitive and require personal interaction are more robot proof but do not support the idea that creative jobs or jobs requiring specialized knowledge are more robot proof. At the same time, jobs that are not repetitive or require personal interaction are not only more robot proof but also more robust against other people and/or poor management.[5]

[5] This is consistent with jobs based on 'routine' tasks being identified by Autor et al. (2003) as in danger of being replaced by computers and by Jensen and Kletzer (2006) as being in danger of being replaced by off-shoring.

Of course, the above regressions omit many other variables that might be relevant to job insecurity. Other correlates of job insecurity that are found in the literature (see Sverke et al. (2006) and Shoss (2017) for reviews) include age, gender, race, education, industry, manual versus white-collar work and professional/managerial distinction. Hence, I next include additional controls to capture these variables in the regressions.[6] Table 4 provides the results of these more comprehensive regressions.

[Table 4 about here]

Adding extra controls largely confirms the earlier results. Having a job that involves considerable personal interaction is associated with a substantial decrease in the chance of being concerned about job loss, though, for robot-related concerns about current and future jobs, the coefficient is insignificant. Having a repetitive job instead is only significantly correlated with the fear of being replaced by machines or computers (a modest +3 percentage points). As before, creativity and specialized knowledge are not significant for robot-related concerns. However, having a job that requires specialized knowledge correlates with increased worries about other people and poor management, while creativity is related to increased worries about being left behind.

As for the control variables, I do not find any evidence of gender specificity in job insecurity. Similarly, age is typically insignificant, with the exception of older people being more likely to be concerned that their job will not exist 50 years from now. Compared with white respondents, African American/black respondents are about 10 percentage points more likely to be concerned about the long-run impact of robots but are equally concerned about their current job. Respondents of other races, in contrast, are more concerned about job insecurity than white respondents but not always significantly so.

Respondents with a high school degree or less are most concerned about the job security of their current job, though there is no significant difference when it comes to concerns about the existence of their job 50 years from now or about robots in the next 50 years carrying out much of the work that humans currently perform.

Respondents who work part-time are more likely to be concerned about not being able to keep up, while the self-employed are less concerned about their current job and especially less concerned about poor quality of management (-21 percentage points). Various types of

[6] Table A1 gives the definitions of the various control variables we add.

organization do not differ in terms of their concern about robots, though people who work in schools and non-profit organizations are less concerned that their job will no longer exist 50 years from now. Working for a non-profit organization, however, is accompanied by a higher chance of being concerned about a declining industry. People who work for the government are generally less concerned about job insecurity, though only significantly so in terms of concerns about other people and poor management. Respondents with a job involving manual or physical work tend to be more concerned about their job, especially the impact of other people and of machines and computers. At the same time, they are less concerned about their job still existing in 50 years than managers and executives and administrative, clerical and customer service staff.

Summarizing, based on these more comprehensive regressions, I find that, ceteris paribus, repetitive jobs are the least robot proof, while creative jobs or jobs requiring highly specialized skills are not more (or less) robot proof. Jobs involving a large amount of personal interaction protect against all kinds of job loss concerns, but the evidence about whether they provide robot proofness is not particularly strong. In addition, having little education (high school or less), being non-white and having a job that involves manual/physical work tends to be associated with a higher chance of being concerned about job insecurity in general.

III. Conclusions

In this paper, I use recent data from a Pew survey to study the relationship between individual, job and company characteristics and respondents' job insecurity. I find that, despite all the media attention paid to the possibility of robots replacing people, a bigger share of employed people is worried about other people taking their job than about machines taking their job. Given that poor management is making even more people worried about losing their job, politicians who are interested in tackling job insecurity have an alternative to restricting the use of robots: promoting better management, an alternative that would not only address the worries of more people but also be better for the economy.

Second, I find that people are more concerned about robots taking other people's job than their own. Third, the vast majority of those concerned about robots are also concerned about the security of their job for other reasons. Hence, robots exacerbate the problems of those who have other reasons for job insecurity rather than creating insecurity for many people who have so far felt secure in their job. Similarly, the characteristics of jobs that are associated with concerns about robots are typically also associated with other reasons for job insecurity:

respondents with no education after high school, respondents with manual jobs and non-white respondents are more likely to feel threatened by machines but also have other reasons to fear for their job.

Fourth, I find fairly limited evidence in support of job or skill characteristics that experts often view as robot proof. I find that people in jobs that involve a large amount of repetition feel, ceteris paribus, significantly more threatened by machines, though the difference is only modest. Moreover, I find that having a job that requires creativity or specialized knowledge correlates little with concerns about machines. Finally, having a job that requires interaction with other people is not significantly associated with fear of robots but does seem to protect against many other sources of job insecurity.

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Table 1: respondents' views on job insecurity

Question	Options	Answer	Share (%)
Potentially Losing Current Job	Your employer finds someone who is willing to do your job for less money	Very/Somewhat concerned	18.18
	The company that you work for is poorly managed	Very/Somewhat concerned	26.07
	Your employer uses machines or computer programs to replace human workers	Very/Somewhat concerned	9.09
	You aren't able to keep up with the technical skills required to do your job	Very/Somewhat concerned	12.49
	Your overall industry is shrinking	Very/Somewhat concerned	21.88
Job will exist in its current form in 50 years?		Definitely NOT /Probably will NOT exist	19.28
in the next 50 years, robots and computers will do much of the work humans currently do		Definitely/Probably will happen	59.74

N=1001.

Table 2: share of those fearing machines who also have other sources of job insecurity

	Option	Share
(a)	Your employer finds someone who is willing to do your job for less money	79.12
(b)	The company that you work for is poorly managed	80.22
(a) and/or (b)		90.11
(c)	You aren't able to keep up with the technical skills required to do your job	62.64
(d)	Your overall industry is shrinking	75.82
Any of (a),(b),(c),(d)		93.41

N=91

Table 3: Regressing Job Concerns on Job Characteristics

	Machines	Job exists 50 year	Robots do work of humans	Other people	Technical skills	Declining Industry	Poor management
Lots of personal interaction	-0.053**	-0.041	-0.094***	-0.094***	-0.112***	-0.121***	-0.105***
	(0.024)	(0.03)	(0.036)	(0.031)	(0.029)	(0.033)	(0.035)
Specialized technical knowledge	-0.024	0.041	0.005	0.023	0.003	-0.027	0.028
	(0.022)	(0.028)	(0.036)	(0.028)	(0.024)	(0.031)	(0.032)
Creativity	0.004	-0.018	-0.017	0.033	0.046*	0.018	0.051
	(0.024)	(0.031)	(0.039)	(0.03)	(0.025)	(0.033)	(0.035)
Repetitive	0.061***	0.029	0.055*	0.042*	-0.008	0.003	0.066**
	(0.018)	(0.026)	(0.033)	(0.025)	(0.023)	(0.028)	(0.029)
Constant	0.107***	0.190***	0.643***	0.186***	0.178***	0.315***	0.240***
	(0.035)	(0.042)	(0.049)	(0.041)	(0.038)	(0.046)	(0.046)
Observations	1001	1001	1001	1001	1001	1001	1001
Adj. R-squared	0.014	0.001	0.006	0.009	0.019	0.012	0.012

Coefficients from OLS regressions with robust standard errors. Standard errors in parentheses, * p<0.10, ** p<0.05, *** p<0.01. The dependent variable is a dummy variable that is one if the respondent is very/somewhat concerned, or says something definitely or probably will happen/exist. Variable definitions are given in table A1

Table 4: Regressing Job Concerns on Job Characteristics, Individual Characteristics and Firm Characteristics

	Machines	Job exists 50 year	Robots do work of humans	Other people	Technical skills	Declining Industry	Poor management
Lots of personal interaction	-0.034	-0.041	-0.085**	-0.083***	-0.093***	-0.104***	-0.092***
	(0.023)	(0.032)	(0.038)	(0.031)	(0.027)	(0.033)	(0.035)
Specialized technical knowledge	0.007	0.028	0.02	0.062**	0.027	0.004	0.060*
	(0.022)	(0.03)	(0.038)	(0.029)	(0.022)	(0.032)	(0.033)
Creativity	0.009	-0.005	-0.004	0.017	0.049*	0.008	0.055
	(0.024)	(0.033)	(0.04)	(0.031)	(0.027)	(0.034)	(0.036)
Repetitive	0.036**	0.033	0.041	0.01	-0.022	-0.012	0.036
	(0.019)	(0.028)	(0.035)	(0.026)	(0.023)	(0.03)	(0.03)
Men	-0.004	-0.019	0.027	0.012	0.032	0.04	0.007
	(0.019)	(0.027)	(0.034)	(0.026)	(0.021)	(0.028)	(0.029)
Age	0.001	0.003***	0	0.001	0.001	0	-0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Black or African-American	0.034	0.096**	0.125***	0.051	0.006	-0.035	0.01
	(0.03)	(0.044)	(0.048)	(0.041)	(0.031)	(0.039)	(0.045)
Other Race	0.114***	0.002	0.115**	0.093**	0.106***	0.100**	0.063
	(0.035)	(0.038)	(0.045)	(0.041)	(0.038)	(0.042)	(0.045)
Some college, no degree	-0.097***	-0.018	-0.009	-0.114***	-0.104***	-0.138***	-0.115***
	(0.032)	(0.039)	(0.051)	(0.04)	(0.031)	(0.041)	(0.044)
Two year associate degree from a college or university	-0.109***	-0.009	-0.052	-0.063	-0.007	-0.107**	-0.069
	(0.034)	(0.047)	(0.063)	(0.05)	(0.043)	(0.049)	(0.054)

Four year college or university degree	-0.087***	0.031	-0.012	-0.115***	-0.03	-0.061	-0.033
	(0.029)	(0.039)	(0.049)	(0.04)	(0.033)	(0.042)	(0.045)
Postgraduate or professional degree	-0.087***	0.021	-0.054	-0.081*	-0.051	-0.06	-0.090*
	(0.032)	(0.047)	(0.057)	(0.046)	(0.038)	(0.048)	(0.052)
Part-time	0.005	0.005	0.056	-0.018	0.076**	-0.017	-0.009
	(0.026)	(0.033)	(0.041)	(0.032)	(0.032)	(0.034)	(0.037)
Self Employed	-0.041	0.019	0.126	-0.053	-0.099*	-0.119	-0.213***
	(0.046)	(0.092)	(0.101)	(0.079)	(0.051)	(0.083)	(0.053)
A medium-size company	0.043	0.029	0.006	0.048	0.021	-0.003	0.039
	(0.032)	(0.042)	(0.049)	(0.04)	(0.035)	(0.041)	(0.047)
A small business	-0.039	-0.013	-0.038	-0.051	-0.041	0.015	-0.028
	(0.024)	(0.035)	(0.042)	(0.032)	(0.029)	(0.036)	(0.038)
government	-0.004	-0.044	-0.021	-0.073*	-0.047	-0.042	-0.088*
	(0.033)	(0.05)	(0.062)	(0.043)	(0.037)	(0.048)	(0.05)
school or educational institution	-0.014	-0.101**	-0.056	0.054	-0.008	0.02	0.011
	(0.029)	(0.044)	(0.058)	(0.047)	(0.038)	(0.048)	(0.052)
A non-profit organization	0.011	-0.104**	-0.139**	0.041	-0.042	0.138**	-0.004
	(0.034)	(0.047)	(0.066)	(0.052)	(0.035)	(0.059)	(0.056)
Other type of organization	0.035	0.055	-0.024	0.006	-0.002	-0.003	-0.012
	(0.084)	(0.12)	(0.118)	(0.104)	(0.086)	(0.106)	(0.111)
Professional	-0.072***	0.02	-0.002	-0.083**	-0.035	-0.075**	-0.038
	(0.024)	(0.035)	(0.047)	(0.036)	(0.031)	(0.038)	(0.042)
Manager or executive	-0.095***	0.093*	0.041	-0.130***	-0.085**	-0.133***	-0.077
	(0.025)	(0.051)	(0.06)	(0.041)	(0.036)	(0.044)	(0.052)
Government official	-0.156***	-0.038	-0.296*	-0.145	0.03	-0.16	-0.154

	(0.037)	(0.098)	(0.161)	(0.118)	(0.143)	(0.113)	(0.11)
Administrative or clerical	-0.058	0.158**	-0.052	-0.126***	-0.06	-0.06	-0.087
	(0.04)	(0.062)	(0.071)	(0.047)	(0.04)	(0.055)	(0.058)
Customer service	-0.074**	0.103**	0.036	-0.057	-0.035	-0.001	-0.003
	(0.032)	(0.052)	(0.058)	(0.046)	(0.037)	(0.052)	(0.054)
Other Type of Work	-0.114*	0.122	0.034	-0.152*	-0.005	-0.031	0.108
	(0.069)	(0.114)	(0.118)	(0.088)	(0.099)	(0.111)	(0.127)
Constant	0.145***	0.049	0.635***	0.263***	0.133**	0.347***	0.370***
	(0.052)	(0.066)	(0.082)	(0.064)	(0.059)	(0.069)	(0.075)
Observations	1001	1001	1001	1001	1001	1001	1001
Adj. R-squared	0.062	0.022	0.016	0.041	0.047	0.035	0.027

Coefficients from OLS regressions with robust standard errors. Standard errors in parentheses, * p<0.10, ** p<0.05, *** p<0.01. The dependent variable is a dummy variable that is one if the respondent is very/somewhat concerned, or says something definitely or probably will happen/exist. Variable definitions are given in table A1

Table A1: Variable Definitions

	Definition
Machines	Your employer uses machines or computer programs to replace human workers (very/somewhat concerned =1)
Job exists 50 year	How likely do you think it is that job will exist in its current form in 50 years? (Definitely/Probably =1)
Robots do work of humans	In the next 50 years, robots and computers will do much of the work currently done by humans? (Definitely/Probably=1)
Other people	Your employer finds someone who is willing to do your job for less money (very/somewhat concerned =1)
Technical skills	You aren't able to keep up with the technical skills required to do your job (very/somewhat concerned =1)
Declining Industry	Your overall industry is shrinking (very/somewhat concerned =1)
Poor management	The company that you work for is poorly managed (very/somewhat concerned =1)
Lots of personal interaction	Your job involves a great deal of personal interaction with customers or clients (Yes =1, 0=No)
Specialized technical knowledge	Your job requires specialized technical knowledge (Yes =1, 0=No)

Creativity	Your job requires specialized technical knowledge (Yes =1, 0=No)
Repetitive	Your job requires that you do the same things over and over (Yes =1, 0=No)
Men	Gender
Age	Age in years
White (omitted category)	Self-identified race
Black or African-American	Self-identified race
Other Race	Self-identified race includes Asian or Pacific Islander, Mixed race, Native American/American Indian, Other, Don't know and Refused
High School or less (omitted category)	High school graduate (Grade 12 with diploma or GED certificate) or less
Some college, no degree	Some college, no degree (includes some community college)
Two year associate degree from a college or university	Two year associate degree from a college or university
Four year college or university degree	Four year college or university degree/Bachelor's degree (e.g., BS, BA, AB) And Some postgraduate or professional schooling, no postgraduate degree
Postgraduate or professional degree	Postgraduate or professional degree, including master's, doctorate, medical or law degree (e.g., MA, MS, PhD, MD, JD)
Full-time (omitted category)	Full-time job
Part-time	Part-time job
Self Employed	Self Employed
A Large company (omitted category)	A Large company
A medium-size company	A medium-size company

A small business	A small business
Government	A part of the federal, state or local government
school or educational institution	school or educational institution
A non-profit organization	A non-profit organization
Other type of organization	Other type of organization
Manual (omitted category)	Job involves manual and physical labor
Professional	Professional
Manager or executive	Manager or executive
Government official	Government official
Administrative or clerical	Administrative or clerical
Customer service	Customer service
Other Type of Work	Other Job Type